deavor to show errors in Spearman's work do not clearly differentiate between inconsequential and material errors in his mathematical processes. Every statistician at times makes assumptions of normality, rectilinearity, independence between variables, etc., which are not strictly true. It is not sufficient that the critic establish the fact that the assumption is inaccurate; he must go further and show that it leads to material error. Several of the Brown and Thomson criticisms of Spearman fail to establish the material nature of the error in the Spearman assumptions, *e. g.*, the error involved in using $r_{xy}$ in the formula for correction for attenuation in place of $\sqrt[4]{r_{x_1y_1}r_{x_1y_2}r_{x_2y_1}r_{x_2y_2}}$.

The "Sampling Theory of Ability" formulated by Thomson seems to the reviewer to be a concise statement of a point of view already held by many psychologists. It is a distinct addition, however, to have it so definitely stated as to suggest an experimental and mathematical testing and comparison with alternative theories.

On the whole, Brown and Thomson have made a contribution which is not only helpful in the detailed problems of psychological statistics but suggestive and forward-looking in the more subtle problems of mental acquisition. It will find a place in every psychological library and laboratory.

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*Report of the Federal Trade Commission on the Pacific Coast Petroleum Industry. Part 1: Production, Ownership, and Profits.* Washington: Government Printing Office, April 7, 1921. 276 pp.

The investigation resulting in this report was authorized by a resolution of the Senate passed on July 31, 1919. The resolution was introduced by the Senator from Washington, and the occasion of the resolution was the "recent advance in the market price in the United States, especially on the Pacific coast, of fuel oil, kerosene, gasoline, and other petroleum products." The results of the investigation were transmitted to the Senate on April 7, 1921, and Part 1 of the report was made available to the public several months later,[1] fully two years after the inception of the investigation and at a time when the prices of petroleum products were slowing up from the most precipitous decline in the history of the industry.

The report is the result of a detailed study of the records of a large number of operating companies, supplemented by additional information gathered through questionnaires, and a thorough compilation of published statistics. The work of analysis is handled largely by means of accounting technique, with only incidental employment of supplementary methods of economic analysis. The data are studied mainly from the point of view of conditions within the petroleum industry; the bearing of fundamental economic factors such as the price

[1] A brief summary of the report was published more promptly under the title, *Summary of Report of the Federal Trade Commission on the Pacific Coast Petroleum Industry. Part 1: Production, Ownership, and Profits.* The second part of the report (yet to appear) "will discuss the prices of crude petroleum, of fuel oil, and refined petroleum products in the principal markets on the Pacific coast, the methods of distribution and of marketing such products, and the conditions of competition in the entire Pacific coast territory."

level, the phase of the business cycle, the rate of earnings in other industries, and the flow of investment funds are not evaluated. In consequence, a great wealth of raw and refined statistics is assembled, many generalizations of current conditions are placed upon a quantitative basis, and the structure of the industry is measured in many respects; but the underlying reasons for the conditions analyzed, being beyond the authorized scope of the investigation, are not brought forth.

Some of the main conclusions reached in Part 1 of the report may be summarized as follows:

1. All branches of the petroleum industry on the Pacific coast—production, refining, and marketing—are "dominated by a few large interests which control most of the proven lands and operate nearly all the pipe-line and refining equipment." For example, seven large interests on March 1, 1920, owned 68 per cent of the proven land of California and in 1919 produced 71.5 per cent of the total crude petroleum output of the state; while five companies were the only important factors in the fields of transportation, refining, and marketing.

2. The costs of producing crude petroleum vary widely among different fields and among different companies in the same field. The chief factor in cost is the volume of production per well. For all companies investigated the average cost of producing crude petroleum in California was 27.4 cents per barrel in 1914, and 46.3 cents per barrel in 1919. Costs vary inversely with the volume of production. In 1919 the companies producing over 1,000,000 barrels annually showed an average cost of 24.5 cents per barrel, while producers with a yearly output of 50,000 barrels and under supported an average cost of $1.21 per barrel.

3. The cost of refining crude petroleum in California, including the cost of crude, was $0.738 per barrel in 1916, and $1.259 a barrel for the first half of 1920. The principal element in the cost of a barrel of refined products is the raw material, crude petroleum, which represented 74 per cent of the total cost in 1919.

4. The average rate of earnings of the five large integrated companies operating in California was 8.3 per cent in 1914; 7.0 per cent in 1915; 14.4 per cent in 1916; 19.2 per cent in 1917; 26.0 per cent in 1918; and 23.6 per cent in 1919 (first half); or an average of 17.0 per cent over the entire period. The rates of earnings are somewhat greater than those shown in the companies' books, because of certain readjustments made by the Commission but not explained in full detail in the report.

5. An analysis of the petroleum industry of the whole country for the year 1919 indicates that the profits of the California petroleum industry were not exceptional as compared with other sections of the United States. Eighty-two producing companies in all parts of the country in 1919 enjoyed an average rate of earnings of 17.7 per cent on their petroleum business. Returns from 138 refining companies in all parts of the country showed an average rate of earnings of 20.0 per cent for 1919. Those refiners who made use of pressure stills for converting gas oil into gasoline enjoyed earnings of 25.2 per cent for 1919, while those not employing such processes earned at the much lower rate of 14.6 per cent. The earnings of the refiner varied inversely with the proportion of the crude petroleum consumption produced by themselves; for example, refiners

producing no crude petroleum showed earnings of 24.8 per cent in 1919; refiners producing from 0 to 20 per cent of their crude, earnings of 21.9 per cent; refiners producing from 20 to 50 per cent of their crude, earnings of 16.6 per cent; and refiners producing over 50 per cent of their crude requirements, earnings of 15.7 per cent.

6. The Commission in conclusion repeated certain recommendations which it made in a report to the House of Representatives on June 1, 1920,[1] namely, "(a) that the active support of the Government be given to those engaged in the oil industry to develop production in foreign countries; (b) that methods of drilling for petroleum and the utilization of petroleum products and their substitutes should be a subject of special study in technological and economic aspects with a view to conserving the supply; (c) that the great importance of information regarding changes in industrial and commercial conditions in the oil trade suggests the need of making provision for having such information currently collected and reported for the use of Congress, the public, and the industry."

The report represents an important contribution to our knowledge of the petroleum industry. It should prove useful to operating companies as a basis for comparing costs, and of value to all students and analysts of the petroleum situation. The scope of the investigation, as imposed by its authorization, however, limits the undertaking to an analysis of *results*, whereas, in the reviewer's judgment, an adequate solution of the problem cannot be reached without an evaluation of *causes*.

JOSEPH E. POGUE

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*Market Statistics.* Prepared under the Direction of Carl J. West and Lewis B. Flohr. U. S. Department of Agriculture, Bulletin No. 982. Washington: Government Printing Office. June, 1921. 279 pp.

"The statistics of this bulletin are based primarily upon the data of prices, receipts, shipments, inspections, and other figures of the marketing of agricultural products obtained by the Bureau of Markets in the conduct of its various reporting and regulatory services. Reports of other governmental bureaus have been drawn upon, particularly the Bureau of Crop Estimates for farm prices and farm crop estimates, and the Bureau of Foreign and Domestic Commerce, for exports and imports. In some instances material has been taken from recognized commercial sources to complete or round out the tables."

The remaining 273 pages are made up entirely of tables and occasional footnotes. The book is divided into six parts: 72 tables are devoted to livestock; 6 tables to dressed meats; 18 to wool; 24 to dairy products; 145 to grain, hay, feed, and seeds; 40 to fruits and vegetables; and 14 to cotton.

The total of 319 tables gives the marketing statistician a wide range of tables from which to select various statistical data. The 100 pages devoted to the 72 tables on livestock should give the searcher for detailed information on this subject the very information he seeks. The material on dressed meats is crushed

[1] Report of the Federal Trade Commission in Response to House Resolution No. 501 on *The Advance in Price of Petroleum Products.* Washington: Government Printing Office. 1920.